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ABSTRACT

The purpose of this study was to find out how pupils reached agreement and handled disagreement in science group discourse. Fifth-grade students were observed in small groups and participated in face-to-face interviews. Pupils' methods of reaching agreement--including using social psychological means--and ways of addressing disagreement--including using plausible persuasion, compromising, or showing indifference--are described. Problems with trying to analyze small group agreement and disagreement in terms of Piagetian and Vygotskian learning theories are also discussed. Contains 18 references. (WRM)

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Different Ways to Reach Agreement and to Handle Disagreement in Science Group Discourse

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Abstract

The purpose of this study was to find out how pupils reached agreement and handled disagreement in science group discourse. There were eighteen groups in three classes of fifth graders who participated in this research and accepted four months of classroom observation and face-to-face interviews. Five to seven pupils were in each group. Results of this study indicated that as the pupils engaged in discussion, in addition to reaching agreement by sharing the same viewpoint or plausible explanation, they might have used social psychological means to reach apparent agreement. With regard to situations of disagreement, besides persuading opponents with plausible explanations, many pupils dealt with the problem by compromising or showing an indifferent attitude so as to prevent disputes from happening. It was also found that different pupils tended to show different reactions in "agreement" and "disagreement" situations. The findings of this study are discussed in terms of the theoretical viewpoints of Piaget and Vygotsky. The deficiency of applying their theories to the investigation of intra-group interactions is pointed out, and further investigation along this line using other approaches is also suggested.

Key Words: agreement, disagreement, group interaction, peer discussion

Different Ways to Reach Agreement and to Handle Disagreement in Science Group Discourse

I. Introduction

Small group work is familiar to researchers in science education, and it is a general practice in many science classrooms. From the social constructivism point of view, many researchers and science teachers suggest that schools should provide pupils with more opportunities to negotiate, compromise, and appreciate each other's opinions (Alexopoulou & Driver, 1996; Atwater, 1996; Hogan, 1998; Pizzini & Shepardson, 1992; Woodruff & Meyer, 1997). Vygotsky pointed out that interaction between children and adults (or between children and children with better abilities) can help children to upgrade their cognitive level (Howe, 1996; Tudge, 1990). For this reason, more and more scholars along with teachers encourage pupils to learn by joining in peer discussion; moreover, some researchers have also begun careful studies interaction processes (e.g., Alexopoulou & Driver, 1996; Bianchini, 1997; Richmond & Striley, 1996; Shepardson, 1996; Woodruff & Meyer, 1997). As much as one would like to think that discussion and negotiation between children is rational and carried out on the basis of equal right in dialogue, it is doubtful that this actually takes place. Earlier studies on peer persuasion were based on an information processing model, which is specifically concerned with how people personally process arguments presented in a persuasive message, that is, "Who says what in which channel to whom with what effect?" On this point, students within a group are regarded as talking to each other with the same status. Information transmission during discussion has been the focus for most researchers using this paradigm. However, more and more scholars had begun in recent years to adopt other approaches. Instead of using an information processing model, social exchange theorists focus on the interchange that takes place between the message source and the recipient (Koballa, 1992). Therefore, interaction between peers differing in race, gender, academic achievement, social status, and so forth may involve social psychological factors which influence discussion behaviors between pupils, in addition to factors coming from logic and powerful evidence which bring about the "being persuaded". Jones and Carter (1994) conducted pair discussions on the concept of balance. It was found that low-achieving students mostly agreed with the high-achieving pupils' viewpoint. In other words, since low-achieving students were used to trusting high-achieving peers in the past, they wouldn't propose their opinions or raise any doubts in most circumstances. It was suggested that social psychology plays a more important role than we used to think in children's "agreement" and "disagreement" behaviors during peer discussions as merely reflecting individual cognitive processes.

In addition to this social psychological issue, status has been more and more emphasized recently by many researchers studying collaborative learning or group discussion among students (Cohen & Lotan, 1995). Bianchini (1997) pointed out that students of high status (due to perceived academic ability and popularity) had greater access to their groups' materials and discourse. Likewise, this phenomenon was found by a science teacher who participated in a study by Woodruff and Meyer (1997). As the science teacher noted, some students in small groups dominated the discussions, making unilateral decisions for the whole group, while other students remained passive. It seemed to echo Perkins and Montgomery (1992) concern that asymmetrical relations indeed exist

between actors in a classroom. What happens during the process of student discussion? What does it mean when students say they have reached agreement in a group discussion?

Based on the idea mentioned above, this study aimed to find out how pupils reached agreement and handled disagreement in science group discourse. In order to achieve this goal, it must be pointed out that the distinction between "agreement" and "disagreement" is actually not clear-cut. Generally speaking, one tends to think that "agreement" means a person joining in a dialogue totally agrees with the viewpoint of somebody else in his group while "disagreement" means that he/she opposes it. It is obvious that this kind of interpretation will face some kinds of uncertainty; for instance, if someone indicates his/her agreement with words and obvious behaviors but in fact still thinks differently, or if someone doesn't respond during discussion, then it will be difficult to distinguish between "agreement" and "disagreement". With regard to this point, this study aimed to find out how pupils reached agreement and handled disagreement during peer discussions by judging their apparent responses and obvious behaviors rather than by determining if the participants actually believed or opposed their peers' viewpoints.

II. Method

To understand the meaning by students and discussion behavior as a whole, the research methods used in this study consisted mainly of classroom observation and non-structured interviews. Fieldwork for this study was conducted during the second semester for four months in the 1997 academic year. The subjects were 116 fifth graders of an elementary school, from three classes taught by the same teacher who was used to conducting her science teaching using peer discussion. Each class was divided into six small groups, and each group of 5-7 pupils was formed according to their seat numbers (say, from one to three for boys and from twenty-six to twenty-nine for girls for the first group). Except for special cases (such as school transfer or for classroom management), the members of each small group remained the same. Grouping was done, regardless of pupils' grades, height, oral expression, science skills, etc. There were neither fixed group leaders nor leader elections; everyone simply took turns being a group leader for about one week. The leader was responsible for taking experimental materials from the front of the classroom, keeping records, and making a final report for his/her own group.

Group work was commonplace in these classes. The teacher asked the pupils to predict what would happen in events involving scientific phenomena, to explain the reasons why, and to try to convince other pupils in the group so that they could reach a consensus. Pupils were often asked to finish a task or solve a problem at the end of each instructional unit, using the science concepts previously studied and the materials available. Keeping any possible interference with the science teacher's teaching schedule to a minimum, the researchers provided four problems for the teacher to use in connection with her regular teaching practices. The four problems are: 1. Why we can see things? 2. Can human beings see a desk in a totally dark room? 3. Can a cat see a desk in a totally dark room? 4. Can a bigger iron nail attract smaller ones while it is in coil without touching any battery? Group discussions were observed and video taped by the junior researcher (Chiang, C. L.), for different groups at different times. All the groups were observed with no specific plan. A number of pupils were chosen for non-structured interviews from time to time. The interview focused on the students' explanations and feelings about events which happened in their groups.

III. Findings

Some interesting findings from the results of analysis as to how pupils reached agreement and handled disagreement during small group discussion are as follows. In order to present fruitful and dynamic information obtained from student interaction, narratives were prepared. Narratives in educational studies help both researchers and readers to gain a better understanding of the actions of teachers and students, and they also take shape as a rhythm that ultimately springs from patterns implicit in human life and action (McEwan and Egan, 1995; Yager and Smith, 1990). Generally speaking, narratives follow no particular format and are not bound to provide evidence concerning the credibility of their findings. It is more important to note that the strength of narratives lies in providing the reader with a great deal of rich information concerning program ideas and options (Yager & Smith, 1990). Since student discussion of science is influenced by the credibility of their findings, it is important that the strength of narratives lies in providing the reader with a great deal of rich information concerning program ideas and options (Yager & Smith, 1990). Since student discussion of science are influenced not only by their content knowledge, but also by the complex contexts in which the discussion takes place, the main findings of this study are presented in a number of narratives. Students' names were changed in order to make the narratives anonymous.

1. Reasons for Reaching Agreement:

Analysis of the processes through which pupils reached apparent agreement in small group work indicated that there were different means of reaching agreement.

A. Agreement based on the same viewpoint

It is reasonable that participants will agree with others' viewpoints, when they have the same point of view on a certain topic. As each other makes sure they are on the same side, participants increase in confidence. Meanwhile, if pupils focus more on the answer to a given problem than on the reasons, the time they spend in compromising will be shorter than that spent reaching other types of agreement.

Narrative 1:

The following discussion took place among students in the first group of the first class. The topic was on "Why can we see things?" It was Sylvia's turn to be a group leader this week. The discussion started. Arthur was the first one to talk.

Arthur: "Why can we see things? It is because we have eyes and light."

Hugo: "With eyes. We can't see if electric power fails or if it occurs at night."

Arthur: "Yes, we need light so that it can reflect to our eyes."

Hugo replied, "Yeah, our eyes need light."

Arthur said," We should make use of light to reflect scenes into our eyes."

Sylvia asked, "And how about you?"

Hugo answered, "Me? I have the same viewpoint. With light, we can see using our eyes." (1-1/4-16/1)

In the above discussion, because of the order of seat assignment, Arthur expressed his viewpoint first. Because Hugo and Arthur shared the same idea, Hugo joined Arthur immediately. Both of them confirmed each other's points of view so that their confidence in giving answers increased.

B. Agreement according to plausible explanations

This type of discussion usually involves the presentation of different viewpoints, the result being that one side has to go through the process of reasonable persuasion to make the other side to agree with his idea. The discussion must go through a reasonable conviction to force the members of the whole group to come to agreement. The discussion process is very complicated, involving not only reasonable explanation from one pupil, but also additional elaboration from other pupils who make a certain reason more and more plausible and persuasive. There is also the possibility that the original idea and viewpoint of a certain pupil may be given up on because of others' participation.

The following scenarios occurred in the first discussion group in one of the three classes observed in this study. The topic they one of the three classes in this study. The topic they discussed was "Can a cat see a desk in a closed dark room?" Before the students began their discussion, the teacher asked each of them to write down what they thought. Eugene wrote, "A cat can see it because its eyes are brighter." Jo also agreed with Eugene based on the idea that a cat's pupils become smaller in the daytime and larger at night. Rudolph held the same viewpoint with Jo that a cat is able to adjust in a dark room, and that its pupils can enlarge. Nevertheless, Christopher and Freddy didn't agree. They thought that although a cat can see something in the dark, it can't see in a totally dark place; a cat can't see in darkness because there is no reflected light to help it see things, despite the fact that the cat's pupils enlarge.

Narrative 2:

The discussion started. Eugene began to read out what he wrote, and then it was Jo's turn. Freddy took his turn next, but he said his answer was different from the previous two.

Rudolph asked, "Well, is it wrong?"

Jo said, "A cat should be able to see it."

Christopher refuted, "But it can't see in a totally dark place."

Jo spoke firmly: "But a cat is a night walker! Even if it is in a completely dark forest without any moonlight, the cat still has to walk."

Christopher insisted, "There must be a very small light source and a little bit of light."

Jo emphasized, "But if it happens that the cat walks in a VERY, VERY dark forest, even without any moonlight."

Freddy answered: "It still has a moon overhead."

Jo stressed, "I mean without any moon at all."

Rudolph said peacefully, "But, a cat is an animal which can adjust itself in the dark."

Jo responded quickly, "Yeah, even if there is a little bit of light, a cat can see things."

But Rudolph said, "Well, I think Freddy has given us a good explanation because every animal needs light so as to see some things."

Jo continued, " Only a little bit, a little bit of light can help it to see."

Freddy's responded happily, "Yes, yes. But our teacher said the cat had to be in a closed room, totally dark."

Two seconds latter…

Jo spoke more gently, " But a cat can smell."

Freddy answered without thinking, "Sure."

Jo said, " I still don't understand."

Freddy said, "You don't want to change (your idea) if you said you don't understand. O.K. It's your turn (pointing to Rudolph)."

Rudolph: "A cat, of course, can't see (in the dark)."
Jo asked with a tone of depression, "Oh, why?"
Rudolph answered, "Because it is a very dark room."
Jo interrupted: "Oh, I see."
Rudolph continued, " Without any light, the cat can't see."
Jo spoke humbly, "Well, I want to change (my idea)."
Freddy added, "Then animals are all like this."
Jo repeated, "I've changed my mind."
(Words in parentheses were added by the researcher.) (3-1/4 - 10/2)

In the record after the discussion, it was found that Eugene had changed his mind, stating that a cat couldn't see things (in the dark). Rudolph also wrote, "If there is no light, man and cats can't see." Jo wrote the record more clearly: "I changed my mind, too. The wise instructor (Freddy) changed my viewpoint. I think man and cats can't see in a dark room without sunlight."

C. Agreement based on trust

Agreement reached on the basis of trust occurs very smoothly, without any violent dispute or questions. This kind of discussion process usually takes place when only one or two pupils dominate the small group. When one of the participants is regarded as the most knowledgeable and experienced one, and he himself also takes this for granted, he has the power in his group.

Narrative 3:

When Sharon became a group leader, she would gather all the members' answer sheets and read them out one by one. She read her own answer first, and then Becky and Byron's. The three all mentioned: "It was because of eyes." When it came to the third answer, everyone laughed with embarrassment.

As Brenda's answer was reported and read, "It was because of crystal..." Emily immediately asked, "Who wrote that?"

Sharon: "Brenda."
Emily: "I admire her!"
Byron applauded and said with exaggeration: "Oh! It's great!"
Becky followed, "Then let's use her viewpoint."
Byron again: "O.K., use hers."
Brenda said hurriedly, "Let's compromise. Let's compromise."
Byron: "All right, it's fair to vote."
Brenda: "Compromise."
Emily: "Those who approve of Sharon's answer, raise your hand."
Nobody raised his or her hand.
Emily: "Becky, raise your hand."
Becky: "I am not included."
No one voted for her, either.
Emily: "Those who approve of Brenda's, raise your hand."
Except Brenda, all the rest supported her.
Byron: "Over half agree. Pass."
Becky: "Come on. This is a discussion period. How can it be like this?"
Byron: "This a kind of discussion. The result of discussion is like this."
Sharon: "Brenda's answer is O.K."

The others didn't have further opinions. It seemed to be a good conclusion. (2-6/4-10/1)

Brenda was a new student who had just transferred from the another school. She was silent in this class in the beginning, but on the first monthly exam, her score was the best place in the class, and she became a focus of attention. That was the reason why all the other class members rapidly accepted her opinion without further discussion or debate.

D. Agreement based on harmony

Some pupils will agree with their peers because they don't want to argue, but wish to keep a harmonious atmosphere instead, even if their viewpoints are very different from those of others. This behavior occurs among females or pupils with low science grades. These situations are similar to that mentioned by Ryder (1994) in "Women's Ways of Knowing". Ryder found that by maintaining harmony, females frequently gave up on their own ideas when the teacher asked one group of pupils to report the results of their discussion.

The second group in Class Three was carrying out an investigation on the distinction of powder. The teacher directed the students to dissolve each pack of powder in water first, and to then pour iodide solution into a test tube to make each powder solution without mixing. However, the discussion in the group went as follows:

Narrative 4:

Isabel held a glass stick and a powder solution, and asked deliberately, " Stir it?"

Laura said, "Don't mix it. It will ….."

Leonard interrupted and gave a command. He shouted, "Stir it!"

Laura didn't say anything, and Isabel began to mix, clicking the glass stick against the test tube noisily. (3-2/3-20/1)

In the above dialogue, faced with Leonard's behavior, the girls in this group didn't want to argue with him; instead, Laura chose to be silent and Isabel accepted Leonard's instruction silently.

E. Agreement based on self-dignity

Agreement reached on the basis of maintaining self-dignity in the discussion process mostly happens when interaction takes place between students of widely different achievement levels. When a low achieving pupil is not satisfied with inharmonious dialogue, he will treat the brighter peer indifferently. He often responds with "Well", "O.K.", "I agree with him." But when asked what the other pupil said, he only remembers his own comments.

In the discussion in the first group in Class One on the topic "Why can we see?", which was reported previously in Narrative 1, Arthur and Hugo (teaching assistants in the science class) clearly pointed out, "Yes, with eyes, and with light too." They also said, "Be sure to make use of light to reflect scenes into the eyes." Later, Jo, the leader asked Rose to answer:

Narrative 5:

Sylvia: " Rose, please tell us why we can see."

Rose tightly held her answer sheet, not allowing others to look at it. Without looking at her own sheet, she replied softly, " Oh, well. My answer is the same as his (pointing to Arthur)."

(But she had written in her sheet: "Eyes, and eyes won't get hurt." (1-1/4-16/1))

Ivy, who was in the first group in Class Three, also exhibited the same kind of behavior. When the members of the group were discussing the topic "Why can man see things?", it was Christopher's turn to be the group leader. Discussions in this group also started with Eugene. But Eugene's answer didn't get any positive reaction from the rest of the group. Later answers from Jo, Freddy and Rudolph, active leaders in the group, put much pressure on Ivy, the one with average performance in science.

Narrative 6:

The discussion began. Jo said, "Our group leader should be the first speaker."

Freddy refuted, "The group leader must lead the discussion."

Christopher (group leader) said, "Good, Eugene, you first."

Eugene read out his answer, "Because it takes eyes and eyeballs.

Freddy (teaching assistant) (looking bored): "Um..."

Christopher: "Good, and next."

Jo read out what she wrote, "First, man's eye-sight. Second, the retina is like the eyeballs of a convex lens."

Rudolph was surprised: "Oh, this is about HEALTH EDUCATION."

Freddy asked Rudolph, "Do you agree?"

Rudolph kept cool: "Well, wait to see if there is any other answer. You, first."

Freddy read out the answer he wrote: "First, it is because light goes to some object and then reflects to eyes, so light, an object, and pupils are needed to be able to see."

Jo said, "This explanation is reasonable."

Rudolph mumbled: "So it means that what I said is totally wrong."

Freddy turned to Ivy: "Your turn."

Jo followed: "Your turn to read."

Ivy was embarrassed and pointed to Jo, lowering head: "The same as her." But her original draft read: "Things are seen in the eyes. It takes good vision."

Rudolph spoke mildly to Ivy: "You should repeat that again."

Freddy hastened: "Hurry up! Did you write?"

Ivy was nervous.

Freddy said: "Then, Rudolph, your turn." (3-1/4-10/1)

Why didn't Ivy directly read out her own answer, as the other students did? She grasped her answer sheet, not allowing others to see it. What was the reason? After class, she said that she was indeed nervous, for she "was afraid of giving a wrong answer." In order to be on the safe side, she chose to give the same answer as Jo's. In this case, she wouldn't lose self-dignity. (Other students laughed when Eugene gave the wrong answer.) Cases like Rose of Class One and Ivy of Class Three usually occurred among students who are introverted and did not do well in science.

2. Ways to Handle Disagreement

Pupils of average ability tend to have various opinions and can't reach any consensus right away. They often deal with such a situation in different ways.

A. Persuade the opponent using examples or explanation.

As different opinions appear, some pupils will give examples from daily life or will try to offer some reasons to convince their peers, even if they can't make the whole group agree with them in the end. They constantly look for more and more group members to

give them support. This can also lead to agreement among some of the group members.

B. Convince the opponent based on experiments.

As their disputes go around and around, sometimes a pupil will do an experiment personally or ask his opponent to do it to show he/she is right. It appears that a kind of naïve belief experimentation is at work here. At this point, the dialogue usually goes something like, "You can try it if you don't trust me," or "O.K., I'll show you."

Narrative 7:

The teacher distributed boxes containing teaching aids, asking each group to make observations using the three lenses inside the box and to find the differences between convex and concave lenses. Freddy and Jo actively picked up lenses to begin their observations. Freddy put one convex lens under a fluorescent lamp. He found that the light from the lamp all focused on the cover of a textbook, and that it became very bright. After that, he rapidly said to his group: "Look! You see that this makes light converge. It must be a convex lens.

Jo then took one concave lens and imitated Freddy and said, "This one disperses light."

Freddy took the lens from Jo, moving the concave lens up and down, and said: "Nothing disperses. See." His textbook cover didn't appear brighter due to the convex lens. The result was only diffused light.

Rudolph asked, "Do concave lenses make light converge or diverge?"

Jo stated firmly, "A concave lens is divergent, and a convex lens is convergent."

Freddy: "Don't say whether a concave lens will disperse light or not, because we don't know how light disperses. If we say a convex lens will focus light, then we're simply saying that a concave lens will not focus light."

Jo didn't say any more. (3-1/4-10/3)

In their dialogue, it was obvious that Freddy at first attempted to use the result of an experiment – moving the concave lens and observing the light on the textbook cover—to prove that the concave lens didn't disperse light as Jo said. But because he didn't know whether the diffused light was a result of dispersion caused by the concave lens or not, he chose to compromise by saying that a convex lens focuses light while a concave lens doesn't. He insisted on this when Jo repeated again that "a concave lens disperses, and a convex lens focuses light". As for Jo, she kept silent. This compromise answer was recorded as the conclusion of the group.

C. Ease a tense atmosphere by means of compromise.

In order to avoid a tense atmosphere, some children with different opinions will quickly compromise. Although each side doesn't completely agree with the compromise answer, they accept it in order to show respect for each other.

Narrative 8:

Following Narrative 7 described above, the teacher distributed boxes containing teaching aids, asking each group to make observations using the three lenses inside the box and to find the differences between convex and concave lenses. The first group in Class Three had found three additional important differences between convex and concave lenses: whether the image was inverted or upright, whether the image became larger or smaller, and whether it felt concave or convex.

As the teacher came to this group, she asked, "In how many ways are convex

and concave lenses different from one another?"

Freddy: "Three."

The teacher: " Very good. Keep on working to see if there are other differences between them."

After the teacher left, Jo suddenly came up with an idea: "Oh, there is one more difference, that is, a convex lens makes objects appear bigger, and a concave lens smaller."

Freddy: "Is that so?"

Jo, moving the lens up and down in order to show Freddy what was happening, said, "It must be. See, this one makes it appear smaller, and this one bigger."

Freddy: "It won't contract."

Jo put the lens on Freddy's textbook cover and said, "Look!"

Freddy said, after taking a look at it, "It does not contract after all. "

Jo replied, "Look at its size now ", while moving the concave lens, trying to find a suitable focus as in the case of the convex lens.

Freddy: "Too close. It's not good."

Jo: " It contracts. It appears smaller."

When Jo moved the concave lens away from the textbook so as to see a clearly contracted image of the textbook, Freddy uttered, "It looks contracted when the lens is held at a distance, of course."

Jo shouted much louder, "Sure, it becomes smaller."

Rudolph: "What result should be recorded?"

Jo got somewhat excited: " Become smaller!"

Freddy calmly said, " No, there is no contraction. The best we can write is IT DOES NOT BECOME LARGER."

Jo: "O.K."

Rudolph: "It's the convex lens?"

Jo: "No, a convex lens makes an object appear larger, but a concave lens DOES NOT MAKE IT BECOME LARGER."

Freddy: "All right, that's it!" Rudolph began to write.

The researcher asked, "Why did you write down that a concave lens doesn't make it become larger?"

Jo: "It was he (pointed Freddy) who didn't want to (admit that it appeared smaller)."

Freddy: "It was because you held it at a distance from the textbook that it appeared smaller; if you put the lens right on the desk, then it will appear larger."

Rudolph: "Because of ..."

Freddy spoke firmly, "It will not appear smaller." (3-1/4-10/3)

Just as in Narrative 7, instead of admitting that the image of an object became smaller when looked at through a concave lens, Freddy preferred to compromise; that is, "It does not become larger." Jo originally intended to demonstrate with an experiment by putting the lens on Freddy's textbook cover to show that she was right, but Freddy insisted on saying that a concave lens does not make the image look larger. Therefore, Jo accepted the way Freddy put it and arrived at a compromise conclusion.

D. Avoid disputes by keeping silent until the discussion period is over.

Some pupils who don't agree with their opponents will try to maintain a good atmosphere during discussion. When they find disputes are going to occur, they will keep silent as long as their opponent also keeps his mouth shut. They will let this situation continue until the discussion period is over.

Narrative 9:

In the discussion in the sixth group in Class Two (The topic was "If one is in a totally dark room, can he see the desk in the room?"), Sharon and Brenda both asserted that the man can see the desk, but Byron didn't think so. Becky and Emily were not sure.

Sharon: "We can see things easily."

Byron: "Without light, how can one see the desk?"

Emily: "He can see a little bit."

Becky: "Totally unable to see."

Sharon: "He can see it."

Becky: "No, it is because the door is open that you can see it by the door."

Byron: "It means the man can't see the desk at all."

Brenda: "You can't see the desk because you just came in from outside where the sun is bright. But, after a while, when you get used to the room, you will be able to see the desk."

Byron: "No way."

Brenda: "So you can try."

Emily: "But would it be accepted if we see a dark shadow?"

Sharon: "I still consider my opinion right. Miss Huang, is the door tightly closed and no light can enter through under the door? "

The teacher: "Absolutely."

Becky: "Then shall we erase the answer with a correction pen?"

No one replied. Later the teacher instructed the discussion groups to the end their discussion.

Becky: "Why is my idea unacceptable? For what reason?"

Sharon: "But I think it works (to see the desk because of the slit of the door)."

When each group member wrote down what he/she thought after the discussion, Sharon still insisted, "I don't change my mind. I firmly believe what I thought." Brenda also thought so; "I do not change my opinion." Byron wrote, "No change. I do not agree with Brenda." As for Becky and Emily, both of them also held on to their previous beliefs: " One can see the dark shadow," and "unable to see things," respectively. (2-6/4-10/2)

In this case, the whole group didn't reach a "consensus" and was in a situation of disagreement. From the statement above, during the discussion process, Brenda tried to use an experiment to prove her point, saying, "Or you can try" in response to Byron's question l. Meanwhile, when the members of the group couldn't convince each other, they kept silent in the face of the conflict situation.

E. Continue to maintain one's own idea and keep doing one's work without paying attention to others' responses.

When disputes occur, while some group members will express disagreement, some will hold on to their ideas and keep on doing whatever they are doing at the moment. For instance, they will record the result of the discussion on their own or use the experimental equipment in their own ways.

Narrative 10:

The students learned how to use the five senses, vinegar, and a solution of iodide to find the properties of cornstarch, soda, milk powder, and detergent, and wrote down the properties of the powders in their Science notebooks. Then the teacher

asked the students to discuss and write down an operational definition of "milk powder" on a small white board. The second group in Class Three came to the lecture platform to get the writing board. Because Isabel was the group leader this week, she was responsible for writing down the results of the group discussion.

As the white board was being brought back, Leonard immediately said, "In the case of an operational definition, one should not write down directly what the object or stuff is." Becky opened his workbook and said, "Find a reference. Let's take a look at the exercises." Isabel began to write "The second group" on the writing board.

Laura: "Write down milk powder. Milk powder, the two words first."

Isabel wrote down the words.

Leonard said angrily, "No! Idiot! Can you write down from the start the name of the stuff for its operational definition? Get the eraser." (He intended to wipe off the words on the white board.)

Laura and Isabel knocked the desks at the same time, saying, "Duster."

Returning from looking at the other tables,

Gordon said, "All of them wrote MILK POWDER first."

Leonard: "But you can't mention it first. This is for the operational definition, so, No Way!"

The rest of the group stayed silent.

Leonard: "Um. Let me see what to write."

The teacher reminded the whole class: "What is the first thing to write? What should you write first?"

Becky: "Powder."

Leonard talked to himself: "Well, I forgot."

Gordon pointed to the writing board with his index finger: "Let's write powder and two dots (a colon)"

Laura also followed, "powder."

Leonard still insisted, " No way!"

Laura, "It seems to be yellow."

Leonard's tone turned softer, "How could it be?"

Becky read from his notebook and said, "It seems to be yellow and rough."

Laura asked Isabel to write: "It appeared yellow. Come over here."

Gordon: "It looks yellow."

Leonard suddenly thought of something: "We can write like this: there is a kind of powder that appears yellow."

Isabel didn't dare to write before but now began to write, "There is a kind of powder". (3-2/3-20/3)

There is an interesting phenomenon in the narrative above. Based on the impression of what was learned before, Leonard insisted that it was not appropriate to mention the name of the object or stuff directly when stating its operational definition. But the other group members didn't consider this important. When Leonard ordered the group members to wipe off the words "Milk Powder", Laura and Isabel did so. At that time, the whole group stayed silent in response to Leonard's insistence. It appeared that all the members accepted Leonard's statement. Later, when Leonard didn't know what to write, Laura and the other members asked the group leader (Isabel) to write "Milk Powder". Nevertheless, Leonard still insisted: "No way!" "How could it be?" Except for Isabel, the rest remained silent and kept on offering the properties related to milk powder when facing such a serious conflict.

It is worth noting that when there are many different opinions in a peer discussion, different pupils will use different approaches to overcome disagreement. But it is

noteworthy that different types of pupils prefer different approaches. For example, brighter students in science like to give examples and explanations, or do experiments to prove their ideas, or they will try to find an acceptable answer to ease the tense atmosphere. However, those who are not good at science, who are introverted, or who lack self-confidence prefer to remain silent. Those who don't care how their opponent reacts and continue to work alone seem to be pupils with various kinds of characters and ability levels.

IV. Conclusion

From the analyses and narratives presented above, we can see that apparent "agreement" and "disagreement" which take place in group discussion do not show that participants actually agree or disagree with their opponents' viewpoints. Possible reasons for agreement may be based on plausible explanations or mutually shared viewpoints. In addition, agreement may be reached because of trust and an intention to maintain harmony, self-dignity, and so forth. If a dispute is unavoidable, pupils with average abilities won't have obvious debates; instead, they will find many ways to lease the tense atmosphere. Apparently, the importance of social psychological and sociological factors in science group discourse can not be overlooked, and these findings prompt us to discuss students' learning based on Piagetian and Vygotskian theoretical viewpoints.

Piaget's theory of learning is familiar to science educators, especially his stage theory and cognitive learning theory. He is often regarded as giving primacy to individual cognitive processes, especially the evolution of scientific knowledge, by interviewing individual children on a wide variety of problems involving logical reasoning. Therefore, Piaget's theory has been applied to few studies on peer discussion in science learning. In fact, following G. Mead, Piaget emphasized the developing consciousness of the self as a social object that occurs (DeVries, 1997). Concerning the development of the child, he also mentioned the relation between the individual and the social in social cooperation and individual moral development. However, Piaget neither considered various kinds of consensus interaction between peers nor expounded on how social element influence the development of logic. He insisted that "there are social elements in logical knowledge", that "social life is a necessary condition for the development of logic", and that "social life transforms the very nature of the individual" (DeVries, 1997). In Narrative 3 reported above, for example, the students—Byron, Becky, and Emily—gave up on their same answer and accepted Brenda's very quickly the moment they heard Brenda's answer. As Jones & Carter (1994) found, trust between student play an important role when they change their mind sand agrees with someone else's notions.

In contrast to Piaget's view, Vygotsky's view has been applied to many studies on peer discussion. Social and cultural processes are seen as having the primacy in Vygotsky's theory. Moreover, a Vygotskian approach to instruction emphasizes language as a tool to support and promote thinking. It is used as a means of stimulating pupils to reflect and explain their social interaction in order to understand how their experiences and their context-bound knowledge fit into a larger system (Howe, 1996). Vygotsky pointed out the importance of sociocultural histories and the role of mediation of language, which had been little mentioned by psychologists and educators. Nevertheless, he paid little attention to the process by which social and self-identity affect an individual's psychological and cognitive development. He also divided the Zone of Proximal Development (ZPD) vaguely into the "state" of the person, the mentee, and a shared situation between mentor and mentee (Barden & McConney, 1996). Both Rose in

Narrative 5 and Ivy in Narrative 6 were nervous when giving their own ideas. Apparently, low-achieving students' social and self-identities are different from high achieving students; moreover, for the sake of self-dignity, they chose to hide their own answers and to adopt others' answers directly. This also implies that students do not become mentors or mentees spontaneously and voluntarily; rather, they may act one way or another as soon as they figure out the social status structure or the norms in their own groups. Such subtle interpersonal relationships indeed exist in student interaction, and it is worth noticing that results emerging from them were not properly described by Piagetian and Vygotskian viewpoints.

By and large, the means used to study how students learn science in small groups is created from several sources: sociological theories in education; learning theories of social constructivism, social semiotics, situated cognition, and the history, philosophy, sociology, and anthropology of science (Bianchini, 1997). Although these approaches come from different disciplines, collectively, they show that the interaction processes, discourse, social status, group norms, roles etc., which emerge naturally in small groups are very important for a better understanding of how students learn science in small groups. This social-cognitive perspective stands in contrast with those of personal cognition, rational reasoning, and expert/novice problem solving mechanisms. In other words, students are not the same at the start; they hold different pre-conceptions, levels of socioeconomic status, value systems, gender expectancy, and images of self and science. These social factors are present when students' are engaged in science group discussions, and they affect students interaction and learning in ways that need further investigation. Furthermore, as Weinstein (1991) pointed out, when assigned to groups that may contain friends, strangers, perhaps even adversaries, students are often expected to interact harmoniously in crowded, competitive and coercive situations. This highlights the social dimensions of the classroom that our familiarity with schools may mask. In addition, since students' thoughts and behaviors tend to be concealed, and since some of them may refuse to talk, understanding student interaction and its meaning remains a challenging task for classroom researchers who wish to discover what science learning is all about.

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